

63    Microwaving Our Planet

Frey, A.H. Brain stem evoked responses associated with low-intensity pulsed UHF energy. *Journal of Applied Physiology* 23(6):984-988, 1967.

Frey, A.H. and Seifert, E. Pulse modulated UHF energy illumination of the heart associated with change in heart rate. *Life Sciences* 7(Part II):505-512, 1968.

Frey, A.H. Effects of microwave and radio frequency energy on the central nervous system. In Symposium Proceedings. Biological Effects and Health Implications of Microwave Radiation. Richmond, Va., Sept. 1969, pp. 134-139.

Frey, A.H. Biological function as influenced by low power modulated RF energy. *IEEE Transactions on Microwave Theory and Techniques*, Vol. MTT-19, No. 2:153-164, 1971.

Frey, A.H. and Messenger, R. Human perception of illumination with pulsed ultrahigh-frequency electromagnetic energy. *Science* 181:356-358, 1973.

Frey, A.H. and Feld, S.R. Avoidance by rats of illumination with low power nonionizing electromagnetic energy. *Journal of comparative and Physiological Psychology*, 89(2):183-188, 1975.

Frey, A.H., Feld, S. and Frey, B. Neural function and behavior: defining the relationship. *Annals of the New York Academy of Sciences* 247:433-439, 1975.

Frey, A.H. From the laboratory to the courtroom: science, scientists, and the regulatory process. In Risk/Benefit Analysis: The Microwave Case, N.H. Steneck, ed., San Francisco Press, 1982, pp. 197-228.

Frey, A.H. Data analysis reveals significant microwave-induced eye damage in humans. *Journal of Microwave Power* 1985, pp. 53-55.

Frey, A.H. Evolution and results of biological research with low-intensity nonionizing radiation. In *Modern Bioelectricity*, A.A. Marino, ed., Dekker, N.Y., pp. 785-837.

Frey, A.H. An integration of the data on mechanisms with particular reference to cancer. In *On the Nature of Electromagnetic Field Interactions with Biological Systems*, A.H. Frey, ed., R.G. Landes Co., Austin, 1994, pp. 9-28.

Gabovich, P.D., Shutenko, O.I., Kozyarin, I.P. and Shvayko, I.I. *Gigiyena i Sanitariya* 10:12-14, 1979. JPRS 75515, pp. 30-35.

Garaj-Vrhovac, V. et al. Somatic mutations in persons occupationally exposed to microwave radiation. *Mutation Research* 181:321, 1987.

Garaj-Vrhovac, V., Horvat, D., and Koren, Z. The relationship between colony-forming ability, chromosome aberrations and incidence of micronuclei in V79 Chinese hamster cells exposed to microwave radiation. *Mutation Research* 263:143-149, 1991.

Geletyuk, V.I., Kazachenko, V.N., Chemeris, M.K. and Fesenko, E.E. Dual effects of microwaves on single  $\text{Ca}^{2+}$ -activated  $\text{K}^{+}$  channels in cultured kidney cells Vero. *FEBS Letters* 359:85-88, 1995.

- Gel'fon, I.A. and Sadchikova, M.N. Protein fractions and histamine of the blood under the influence of UHF and HF. In The Biological Action of Ultrahigh Frequencies, A.A. Letavet and Z.V. Gordon, eds., Academy of Medical Sciences, Moscow, 1960. JPRS 12471, pp. 42-46.
- Giarola, A.J., Krueger, W.F. and Woodall, H.W. The effect of a continuous UHF signal on animal growth. 1971 IEEE International Electromagnetic Compatibility Symposium Record, Phila., July 13-15, 1971, pp. 150-153.
- Giarola, A.J., Krueger, W.F., and Neff, R.D. The growth of animals under the influence of electric and magnetic fields. Health Physics in the Healing Arts, Seventh Midyear Topical Symposium, Health Physics Society, San Juan, P.R., Dec. 11-14, 1972, published March 1973, pp. 502-509.
- Glaser, Z.R. and Dodge, C.H. Comments on occupational safety and health practices in the USSR and some East European countries: a possible dilemma in risk assessment of RF and microwave radiation bioeffects. In Risk/Benefit Analysis: the Microwave Case, N.H. Steneck, ed., San Francisco Press, 1982, pp. 53-67.
- Goldoni, J. Hematological changes in peripheral blood of workers occupationally exposed to microwave radiation. Health Physics 58(2):205-207, 1990.
- Goldsmith, J.R. Epidemiologic evidence of radiofrequency radiation (microwave) effects on health in military, broadcasting, and occupational studies. Int. J. Occup. Environ. Health 1:47-57, 1995.

Goldsmith, J.R. Epidemiological studies of radio-frequency radiation: current status and areas of concern. The Science of the Total Environment 180:3-8, 1996.

Gorbach, I.N. Changes in nervous system of individuals exposed to microradiowaves for long period of time. Zdravookhraneniye Belorussii 5:51-53, 1982. JPRS 81865, pp. 24-28.

Gordon, Z.V. The problem of the biological action of UHF. In The Biological Action of Ultrahigh Frequencies, A.A. Letavet and Z.V. Gordon, eds., Academy of Medical Sciences, Moscow, 1960, pp. 1-4.

Gordon, Z.V. Hygienic evaluation of the working conditions of workers with UHF generators. Ibid., pp. 18-21.

Gordon, Z.V. and Lobanova, Y.A. Temperature reaction of animals under the influence of UHF. Ibid., pp. 57-59.

Gordon, Z.V. Investigation of the blood pressure in rats (bloodless method) under the influence of UHF. Ibid., pp. 64-67.

Gordon, Z.V., Roscin, A.V. and Byckov, M.S. Main directions and results of research conducted in the USSR on the biologic effects of microwaves. In Biologic Effects and Health Hazards of Microwave Radiation: Proceedings of an International Symposium, Warsaw, 15-18 Oct., 1973, P. Czerski et al., eds., pp. 22-35.

Gvozdikova, Z.M., Anan'ev, V.M., Zenina, I.N. and Zak, V.I. Sensitivity of the rabbit's central nervous system to a continuous superhigh-frequency electromagnetic field. Bulletin of Experimental Biology and Medicine 58(8):943-947.

67    Microwaving Our Planet

Gribbin, J. What's Wrong With Our Weather? the climatic threat of the 21st century. Scribner, New York, 1979.

Grin', A.N. Effects of microwaves on catecholamine metabolism in the brain. Vrachebnoye Delo 10:129-130, 1978.  
JPRS 72606, pp. 14-16.

Hallowell, C. Trouble in the lily pads. Time, Oct. 28, 1996, p. 87.

Hanson, M. What's the fuss about calcium? Interactions between calcium, free radicals and heavy metals and relevance to health. In Electromagnetic Hypersensitivity: Proceedings of the 2nd Copenhagen Conference, May 1995, J. Katajainen and B. Knave, eds., pp. 27-31.

Hanson, M. Do you feel rusty? Heavy Metal Bulletin 3(2)7-9+, 1996.

Hawk, K. Case Study in the Heartland. Butler, Pa., 1996.

Healer, J. Review of studies of people occupationally exposed to radio-frequency radiations. In Symposium Proceedings. Biological Effects and Health Implications of Microwave Radiation. Richmond, Va., S. Cleary, ed., Sept. 1969, pp. 90-97.

Hocking, B. and Gordon, I. Childhood leukemia risk increase associated with TV towers in North Sydney for exposures well below the present public safety standard. D.O.E. poster presentation, Palm Springs Workshop, 1995.

Huai, C. Assessment of health hazard and standard promulgation in China. Biological Effects and Dosimetry of Non-

ionizing Radiation, NATO Conference, Erice, Italy, 1981, pp. 627-644.

IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz. IEEE C95.1-1991.

Infante-Rivard, C. Electromagnetic field exposure during pregnancy and childhood leukaemia. *Lancet* 346:177, 1995.

Inglis, L.P. Why the double standard? A critical review of Russian work on the hazards of microwave radiation. 1970 IEEE International Symposium on Electromagnetic Compatibility, July 14-16, 1970, pp. 168-172.

Ismailov, E.S. Effects of microwaves on the nervous system. All-Union Conference on Problems of Biophysical Neurodynamics and General Biophysics, 1969:27-29. *JPRS* 75515, pp. 34-35.

Johansson, O. and Liu, P.-Y. "Electrosensitivity", "Electro-supersensitivity" and "screen dermatitis": preliminary observations from on-going studies in the human skin. In Proceedings of the Cost 244 Workshop on Electromagnetic Hypersensitivity, N. Leitgeb, ed., Oct. 1994, pp. 52-57.

Johnson, C.C. and Guy, A.W. Nonionizing electromagnetic wave effects in biological materials and systems. *Proceedings of the IEEE* 60(6):692-718, 1972.

Justeson, D.R. Behavioral and psychological effects of microwave radiation. *Bull. N.Y. Acad. Med.* 55(11): 1058-1078, 1979.

Kalnins, T., Krizbergs, R. and Romancuks, A. Measurement of the intensity of electromagnetic radiation from the Skrunda radio location station, Latvia. The Science of the Total Environment 180:51-56, 1996.

Kauppi, M. DNA injuries in electrically sensitive and CFS patients. Heavy Metal Bulletin 3(2):14, 1996.

Kauppi, M. The porphyrin link. Heavy Metal Bulletin 3(2):23+, 1996.

Kitsovskaya, I.A. Investigation of the interrelationships between the basic neural processes in rats under the influence of UHF of various intensities. In The Biological Action of Ultrahigh Frequencies, A.A. Letavet and Z.V. Gordon, eds., Academy of Medical Sciences, Moscow, 1960. JPRS 12471, pp. 75-82.

Klimkova-Deutschova, E. Neurologic findings in persons exposed to microwaves. In Biologic Effects and Health Hazards of Microwave Radiation: Proceedings of an International Symposium, Warsaw, 15-18 Oct., 1973, P. Czerski et al., eds., pp. 268-272.

Knave, B. Research reported in Forskning & Praktik, Apr. 1992, reprinted in Electrical Sensitivity News 1(5):4-5, 1996.

Knoppe, K.G. Parameters of UHF fields determining the hygienic evaluation of working conditions and the problems of their measurement. In The Biological Action of Ultrahigh Frequencies, A.A. Letavet and Z.V. Gordon, eds., Academy of Medical Sciences, Moscow, 1960. JPRS 12471, pp. 5-17.

- Ko, M., Sze, N. and Prather, M. Better protection of the ozone layer. *Nature* 367:505-508, 1994.
- Kolodynski, A.A. and Kolodynska, V.V. Motor and Psychological functions of school children living in the area of the Skrunda Radio Location Station in Latvia. *The Science of the Total Environment* 180:87-93, 1996.
- Kolomytkin, O., Yurinska, M., Zharikov, S., Kuznetsov, V. and Zharikova, A. Response of brain receptor systems to microwave energy exposure. In *On the Nature of Electromagnetic Field Interactions with Biological Systems*, A.H. Frey, ed., 1994, pp. 195-206.
- Kondra, P. A., Smith, W.K., Hodgson, G.C., Bragg, D.B., Gavora, J., Hamid, M.A.K. and Boulanger, R.J. Growth and reproduction of chickens subjected to microwave radiation. *Canadian Journal of Animal Science* 50:639-644, 1970.
- Kondra, P.A., Hamid, M.A. and Hodgson, G.C. Effects of microwave radiation on growth and reproduction of the stocks of chickens. *Canadian Journal of Animal Science* 52:317-320, 1972.
- Konradi, A. Effect of the orbital debris environment on the high-energy Van Allen proton belt. *Science* 242:1283-1286, 1988.
- Korbel Eakin, S. and Thompson, W.D. Behavioral effects of stimulation by UHF radio fields. *Psychological Reports* 17:595-602, 1965.



71    Microwaving Our Planet

Korbel, S.F. and Fine, H.L. Effects of low intensity UHF radio fields as a function of frequency. Psychon. Sci. 9(9):527-528, 1967.

Kowalski, Z. and Indulski, J.A. The strategy of targetted health surveillance. II. Genetically determined susceptibility to chemical substances and other issues related to health surveillance. Polish Journal of Occupational Medicine 3(4):357-374, 1990.

Krasny-Ergen, W. Point heating and mechanical effects of short waves. Archives of Physical Therapy 21:362-366, 1940.

Krueger, W.F., Giarola, A.J., Bradley, J.W. and Shrekenhamer, A. Effects of electromagnetic fields on fecundity in the chicken. Ann. N.Y. Acad. Sci. 247:391-400, 1975.

Kunjilwar, K.K. and Behari, J. Effect of amplitude-modulated RF radiation on cholinergic system of developing rats. Brain Research 601:321-324, 1993.

Kupfer, A. The trouble with cellular. Fortune, Nov. 13, 1995, pp. 179-188.

Lai, H. and Singh, N.P. Acute low-intensity microwave exposure increases DNA single-strand breaks in rat brain cells. Bioelectromagnetics 16:207-210, 1995.

Leitgeb, N. Electromagnetic hypersensitivity. Quantitative assessment of an ill-defined problem. In Proceedings of the Cost 244 Workshop on Electromagnetic Hypersensitivity, N. Leitgeb, ed., Oct. 1994, pp. 68-74.

Lerner, E.J. Biological effects of electromagnetic fields.  
IEEE Spectrum, May 1984, pp. 57-69.

Letavet, A.A. and Gordon, Z.V. The Biological Action of  
Ultrahigh Frequencies. Academy of Medical Sciences,  
Moscow, 1960. JPRS 12471.

Letavet, A.A. and Gordon, Z.V. Recommendations for conducting  
preliminary and periodic medical examinations of workers  
with UHF sources. Ibid., pp. 123-125.

Letavet, A.A. and Gordon, Z.V. Temporary sanitary regulations  
in work with generators of centimeter waves. Ibid, pp. 126-  
130.

Letavet, A.A. and Gordon, Z.V. Temporary instructions on  
the method of measuring the power flux density of UHF  
energy at the working positions. Ibid, pp. 131-133.

Levitt, B.B. Electromagnetic Fields: A Consumer's Guide to  
the Issues and How to Protect Ourselves. Harcourt, Brace,  
N.Y., 1995.

Liebesny, P. Athermic short wave therapy. Archives of  
Physical Therapy, Dec. 1938, pp. 736-740.

Lin, J.C. Microwave Auditory Effects and Applications.  
Charles C. Thomas, Springfield, 1978.

Lobanova, Y.A. and Gordon, Z.V. Investigation of the olfactory  
sensitivity in persons subjected to the influence of UHF.  
In The Biological Action of Ultrahigh Frequencies, A.A.  
Letavet and Z.V. Gordon, eds., Academy of Medical Sciences,  
Moscow, 1960. JPRS 12471, pp. 50-56.

### 73 Microwaving Our Planet

Lobanova, Y.A. Survival and development of animals with various intensities and durations of the influence of UHF. Ibid, pp. 60-63.

Lobanova, Y.A. and Tolgskaya, M.S. Change in the higher nervous activity and interneuron connections in the cerebral cortex of animals under the influence of UHF. Ibid, pp. 68-74.

MacCracken, M.C., Budyko, M.I., Hecht, A.D. and Izrael, Y.A. Prospects for Future Climate: A Special US/USSR Report on Climate and Climate Change. 1990.

Magone, I. The effect of electromagnetic radiation from the Skrunda Radio Location Station on Spirodela polyrhiza (L.) Schleiden cultures. The Science of the Total Environment 180:75-80, 1996.

Maietta, V. Iridium project beams into Tempe. Business Journal, July 26, 1996, pp. 1+.

Maitland, G. and Thomas, J.R. Behavioral effects of daily and weekly  $1 \text{ mW/cm}^2$  electromagnetic radiation (EMR) in rats. Bioelectromagnetics 1:203, 1980.

Makhijani, A. and Gurney, K. Mending The Ozone Hole. Institute for Energy and Environmental Research, 1992.

Mann, K. and Roschke, J. Effects of pulsed high-frequency electromagnetic fields on human sleep. Neuropsychobiology 33:41-47, 1996.

Marha, K. Maximum admissible values of HF and UHF electromagnetic radiation at work places in Czechoslovakia. In Symposium Proceedings. Biological Effects and Health

Implications of Microwave Radiation, Richmond, Va., Sept. 1969, S. Cleary, ed., pp. 188-191.

Marha, K. Microwave radiation safety standards in Eastern Europe. IEEE Transactions on Microwave Theory and Techniques, Vol. MTT-19(2):165-168, 1971.

Marino, A.A. Environmental electromagnetic energy and public health. In Modern Bioelectricity, A.A. Marino, ed., Dekker, N.Y., 1988.

Markarov, G., Markarova, I., Zaslavsky, A. and Geles, U. Hypersensitivity to EMF, and the dependence of brain bio-electrical activity and general hemodynamics in cerebral asthenic (CA) patients, exposed to radioactive irradiation upon EMF 20-80 Hz effect. In Proceedings of the 2nd Copenhagen Conference on Electromagnetic Hypersensitivity, May 1995, J. Katajainen and B. Knave, eds., pp. 57-60.

McRee, D.I. Review of Soviet/Eastern European research on health aspects of microwave radiation. Bull. N.Y. Acad. Med. 55(11):1133-1151, 1979.

McRee, D.I. Soviet and Eastern European research on biological effects of microwave radiation. Proc. IEEE 68(1):84-91, 1980.

Medici, R.G. Considerations for science: where has all the science gone? In Risk/Benefit Analysis: The Microwave Case, N.H. Steneck, ed., S.F. Press, 1982, pp. 177-196.

Mickey, G.H. Electromagnetism and its effect on the organism. N.Y.S. Journal of Medicine, July 1, 1963, pp. 1935-1942.

Microwave News, Nov./Dec. 1995, pp. 1+, report on cancer studies.

Millar, H. Rockets for the rest of us. Wired, Sept. 1996, pp. 102-110.

- Molina, M.J. and Rowland, F.S. Stratospheric sink for chlorofluoromethanes: chlorine atom-catalysed destruction of ozone. *Nature* 249:810-812, 1974
- Morgan-Hughes, J.A., Darveniza, P., Kahn, S.N., Landon, D.N., Sherratt, R.M., Land, J.M. and Clark, J.B. A mitochondrial myopathy characterized by a deficiency in reducible cytochrome b. *Brain* 100:617-640, 1977.
- Navakatikian, M.A. and Tomashevskaya, L.A. Phasic behavioral and endocrine effects of microwaves of nonthermal intensity. In *Biological Effects of Electric and Magnetic Fields*, D.O. Carpenter and S. Ayrapetyan, eds., Academic Press, N.Y. 1994, pp. 333-342.
- National Council on Radiation Protection and Measurements. *Biological Effects and Exposure Criteria for Radio-frequency Electromagnetic Fields*. Report #86, Apr. 2, 1986.
- Newell, R.E. Water vapour pollution in the stratosphere by the supersonic transporter? *Nature* 226:70-71, 1970.
- New Scientist*, 24 Aug. 1996. Are We Killing Astronomy? pp. 28-31.
- Nikogosyan, S.V. Influence of UHF on the cholinesterase activity in the blood serum and organs in animals. In *The Biological Action of Ultrahigh Frequencies*, A.A. Letavet and Z.V. Gordon, eds., Academy of Medical Sciences, Moscow, 1960. JPRS 12471, pp. 83-88.
- National Institute for Occupational Safety and Health. *Hazard Assessment of the Electronic Component Manufacturing Industry*. DHHS Publication #85-100, Washington, Feb. 1985.
- Nuessle, V.D. and Holcomb, R.W. Will the SST pollute the stratosphere? *Science* 168:1562, 1970.

Nutrition Reviews 46(4), 1988. Lactic acidosis and mitochondrial myopathy in a young woman, pp. 157-163.

Ockerman, P. Study of electrosensitive persons reported in Goteborgs-Posten, June 7, 1996. Summarized in Heavy Metal Bulletin 3(2):14, and in L. Sodergren, 1996 EMF Diary.

Olsen, R.G. and Hammer, W.C. Microwave-induced pressure waves in a model of muscle tissue. Bioelectromagnetics 1:45-54, 1980.

Olsen, R.G. Evidence for microwave-induced acoustic resonances in biological material. Bioelectromagnetics 1:219, 1980.

Orlova, A.A. The clinic of changes of the internal organs under the influence of UHF. In The Biological Action of Ultrahigh Frequencies, A.A. Letavet and Z.V. Gordon, eds., Academy of Medical Sciences, Moscow, 1960. JPRS 12471, pp. 30-35.

Oscar, K.J. and Hawkins, T.D. Microwave alteration of the blood-brain barrier system of rats. Brain Research 126: 281-293, 1977.

Ouellet-Hellstrom, R. and Stewart, W.F. Miscarriages among female physical therapists who report using radio- and microwave-frequency electromagnetic radiation. American Journal of Epidemiology 138:775-786, 1993.

Park, C.G. and Helliwell, R.A. Magnetospheric effects of power line radiation. Science 200:727-730, 1978.

Parshad, R. et al. Differential sensitivity of cultured human cells of two-tissue origin to killing by low-level

77    Microwaving Our Planet

- microwave radiation. In Biological Effects of Electropollution, S. Dutta and R. Millis, eds., Information Ventures, Phila., 1986, pp. 71-76.
- Pazderova, J., Pickova, J. and Bryndova, V. Blood proteins in personnel of television and radio transmitting stations. In Biologic Effects and Health Hazards of Microwave Radiation: Proceedings of an International Symposium, Warsaw, 15-18 Oct., 1973, P. Czerski, ed., pp. 281-288.
- Pervushin, V.Y. Changes occurring in the cardiac nervous apparatus due to the action of ultra-high-frequency field. Bull. Exper. Biol. Med. 43:734-740, 1957.
- Prather, M.J., Garcia, M.M., Douglass, A.R., Jackman, C.H., Ko, M. and Sze, N.D. The Space Shuttle's impact on the stratosphere. Journal of Geophysical Research 95(D11): 18,583-18,590, 1990.
- Presman, A.S. and Levitina, N.A. Nonthermal action of microwaves on cardiac rhythm, I. Bull. Exper. Biol. Med. 53(1):36-39, 1962.
- Presman, A.S. and Levitina, N.A. Nonthermal action of microwaves on the rhythm of cardiac contractions in animals, II. Bull. Exper. Biol. Med. 53(2):154-157.
- Presman, A.S. Electromagnetic Fields and Life. Plenum Press, N.Y., 1970.
- Ray, S. and Behari, J. Physiologic changes in rats after exposure to low levels of microwaves. Radiation Research 123:199-202, 1990.

Rea, W.J., Pan, Y., Fenyves, E.J., Sujisawa, I., Samadi, N. and Ross, G. Electromagnetic field sensitivity. *Journal of Bioelectricity* 10:241-256, 1991.

Roberti, B., Heebels, G.H., Hendricx, J.C., de Greef, A.H. and Wolthius, O.L. Preliminary investigations of the effects of low-level microwave radiation on spontaneous motor activity in rats. *Ann. N.Y. Acad. Sci.* 247:417-424, 1975.

Sadchikova, M.N. State of the nervous system under the influence of UHF. In *The Biological Action of Ultrahigh Frequencies*, A.A. Letavet and Z.V. Gordon, eds., Academy of Medical Sciences, Moscow, 1960, pp. 25-29.

Sadchikova, M.N. Clinical manifestations of reactions to microwave irradiation in various occupational groups. In *Biologic Effects and Health Hazards of Microwave Radiation: Proceedings of an International Symposium, Warsaw, 15-18 Oct., 1973*, P. Czerski et al., eds., pp. 261-267.

Sadchikova, M.N., Kharlamova, S.F., Shatskaya, N.N. and Kuznetsova, N.V. Significance of blood lipid and electrolyte disturbances in the development of some reactions to microwaves. *Gigiyena Truda i Professional'nyye Zabolevaniya* 2:38-39, 1980. JPRS 77393, pp. 37-39.

Sagripanti, J. and Swicord, M.L. DNA structural changes caused by microwave radiation. *Int. J. of Rad. Biol.* 50(1):47-50, 1986.

Salford, L.G., Brun, A., Persson, B.R. and Eberhardt, J. Experimental studies of brain tumour development during exposure to continuous and pulsed 915 MHz radiofrequency radiation. *Bioelectrochemistry and Bioenergetics* 30: 313-318, 1993.



79    Microwaving Our Planet

Sarkar, S., Ali, S., Behari, J. Effect of low power microwave on the mouse genome: a direct DNA analysis. Mutation Research 320:141-147, 1994.

Savitz, D.A. and Calle, E.E. Leukemia and occupational exposure to electromagnetic fields: review of epidemiologic surveys. Journal of Occupational Medicine 29(1): 47-51, 1987.

Schmitz, P., Siegenthaler, J., Stager, C., Tarjan, D. and Bucher, J.B. Long-term exposure of young spruce and beech trees to 2450-MHz microwave radiation. The Science of the Total Environment 180:43-48, 1996.

Selga, T. and Selga, M. Response of *Pinus sylvestris* L. needles to electromagnetic fields. Cytological and ultrastructural aspects. The Science of the Total Environment 180:65-73, 1996.

Servantie, B., Servantie, A.M., Etienne, J. Synchronization of cortical neurons by a pulsed microwave field as evidenced by spectral analysis of EEG from the white rat. Ann. N.Y. Acad. Sci. 247:82-86, 1975.

Shandala, M.G. and Vinogradov, G.I. Immunological effects of microwave action. Gigiyena i Sanitariya 10:34-38, 1978. JPRS 72956, pp. 16-21.

Shandala, M.G., Dumanskii, U.D., Rudnev, M.I., Ershova, L.K. and Los, I.P. Study of nonionizing microwave radiation effects upon the central nervous system and behavior reactions. Environmental Health Perspectives 30:115-121, 1979.

Shandala, M.G., Rudnev, M.I., Stoyan, Y.F. and Vinogradov, G.I. Main directions of Soviet research on biological

effects of microwave radiation. Gigiyena i Sanitariya 10:4-7, 1981. JPRS 84221, pp. 75-80.

Shandala, M.G., Vinogradov, G.I., Rudnev, M.I. and Rudakova, S.F. Effects of chronic exposure to microwaves on certain indicators of cellular immunity. Radiobiologiya 23(4):544-546, 1983.

Sherry, S. High Tech and Toxics. Golden Empire Health and Planning Center, Sacramento, 1985.

Shutenko, O.I., Kozyarin, I.P. and Shvayko, I.I. Effects of superhigh frequency electromagnetic fields on animals of different ages. Gigiyena i Sanitariya 10:35-38, 1981. JPRS 84221, pp. 85-90.

Siekierzynski, M. A study of the health status of microwave workers. In Biologic Effects and Health Hazards of Microwave Radiation: Proceedings of an International Symposium, Warsaw, 15-18 Oct. 1973, P. Czerski et al., eds., pp. 273-280.

Sikorski, M. and Bielski, J. Disturbances of glucose tolerance in workers exposed to electromagnetic radiation. Medycyna Pracy 47(3):227-231, 1996.

Silverman, Charlotte. Epidemiologic approach to the study of microwave effects. Bull. N.Y. Acad. Med. 55(11):1166-1181, 1979.

Smirnova, M.I. and Sadchikova, M.N. Determination of the functional activity of the thyroid gland by means of radioactive iodine in workers with UHF generators. In The Biological Action of Ultrahigh Frequencies, A.A. Letavet and Z.V. Gordon, eds., Academy of Medical Sciences, Moscow, 1960. JPRS 12471, pp. 47-49.

81    Microwaving Our Planet

Sodergren, L. 1996 EMF Diary. Goteborg, Sweden.

Sokolov, V.V. and Arievich, M.N. Changes in the blood under the influence of UHF on the organism. In The Biological Action of Ultrahigh Frequencies, A.A. Letavet and Z.V. Gordon, eds., Academy of Medical Sciences, Moscow, 1960, pp. 39-41

Solon, L.R. A local health agency approach to a permissible environmental level for microwave and radiofrequency radiation. Bull. N.Y. Acad. Med. 55(11):1251-1266.

Souder, W. An amphibian horror story. New York Newsday, Oct. 15, 1996, p. B19+.

Steneck, N.H., ed. Risk/Benefit Analysis: The Microwave Case. San Francisco Press, 1982.

Susskind, C. Testimony before the Committee on Commerce hearing on the Radiation Control for Health and Safety Act of 1967. Hearings Before the Committee on Commerce, United States Senate, 90th Congress, 2nd Session on S.2067, S.3211, and H.R. 10790 to provide for the protection of the public health from radiation emissions. Part 2. Serial No. 90-49, U.S. Government Printing Office, Washington, 1968, p. 720.

Szent-Gyorgyi, A. Molecules, electrons, and biology. Trans. N.Y. Acad. Sci. 31:334-340, 1969.

Szmigielski, S., Bielec, M., Lipski, S., and Sokolska, G. Immunologic and cancer-related aspects of exposure to low-level microwave and radiofrequency fields. In Modern Bioelectricity, A.A. Marino, ed., Dekker, N.Y., 1988, pp. 861-925.

Szmigielski, S. and Gil, J. Electromagnetic fields and neoplasms. In Electromagnetic Biointeraction, G. Franceschetti et al., eds., Plenum, N.Y., 1989, pp. 81-98.

Szmigielski, S. Cancer morbidity in subjects occupationally exposed to high frequency (radiofrequency and microwave) electromagnetic radiation. The Science of the Total Environment 180:9-17, 1996.

Szuba, M. and Szmigielski, S. Change in reaction time to auditory and visual signals differentiates individual responses to short-term exposure to ELF electric fields and direct current stimulation. In Proceedings of the Cost 244 Workshop on Electromagnetic Hypersensitivity, Graz, Austria, Oct. 1994, N. Leitgeb, ed., pp. 94-105.

Takashima, S., Onaral, B., and Schwan, H.P. Effects of modulated RF energy on the EEG of mammalian brains. Radiation and Environmental Biophysics 16:15-27, 1979.

Tanner, J.A. Effect of microwave radiation on birds. Nature 210:636, 1966.

Tanner, J.A., Romero-Sierra, C. and Davie, S.J. Non-thermal effects of microwave radiation on birds. Nature 216: 1139, 1967.

Tanner, J.A. and Romero-Sierra, C. Bird feathers as sensory detectors of microwave fields. In Biological Effects and Health Implications of Microwave Radiation, S. Cleary, ed., U.S. Dept. of HEW, Washington, pp. 185-187.

Tarricone, L., Cito, C. and D'Inzeo, G. Ach receptor channel's interaction with MW fields. Bioelectrochemistry and Bioenergetics 30:275-285, 1993.

Teixeira-Pinto, A.A., Nejelski, L.L., Cutler, J.L. and Heller, J.H. The behavior of unicellular organisms in an electromagnetic field. *Experimental Cell Research* 20:548-564, 1960.

Tell, R.A. and Mantiply, E.D. Population exposure to VHF and UHF broadcast radiation in the United States. *Proc. IEEE* 68(1):4-12, 1980.

Thomas, Y., Litime, H., Belkadi, L., Beneviste, J., and Schiff, M. Electronic transmission of phorbol-myristate acetate to human neutrophils. Referenced in P. French, *The Interaction of Electromagnetic Fields with Biological Systems*, 1996.

Tofani, S., Agnesod, G., Ossola, P., Ferrini, S. and Bussi, R. Effects of continuous low-level exposure to radio-frequency radiation on intrauterine development in rats. *Health Physics* 51(4):489-499, 1986.

Tolgskaya, M.S., Gordon, Z.V. and Lobanova, Y.A. Morphological changes in experimental animals under the influence of pulse and continuous UHF. In *The Biological Action of Ultrahigh Frequencies*, A.A. Letavet and Z.V. Gordon, eds., Academy of Medical Sciences, Moscow, 1960. JPRS 12471, pp. 94-103.

Tolgskaya, M.S. and Gordon, Z.V. Changes in the receptor and interoreceptor apparatuses under the influence of UHF. *Ibid.*, pp. 104-109.

Trinos, M.S. Frequency of diseases of digestive organs in people working under conditions of combined effect of lead and SHF-range electromagnetic energy. *Gigiyena i Sanitariya* 9:93-94, 1982. JPRS 84221, pp. 23-26.

- Veyret, B., Bouthet, C., Deschaux, P., de Seze, R., Geffard, M., Joussot-Dubien, J., le Diraison, M., Moreau, J.-M. and Caristan, A. Antibody responses of mice exposed to low-power microwaves under combined pulse-and-amplitude modulation. *Bioelectromagnetics* 12:47-56, 1991.
- Wei, L. Y. A new theory of nerve conduction. *IEEE Spectrum*, Sept. 1966, pp. 123-127.
- Wieske, C.W. Human sensitivity to electric fields. In *Proceedings of the First National Biomedical Sciences Instrumentation Symposium*, Los Angeles, July 14-17, 1962. Reprinted in *Electrical Sensitivity News* 1(5): 1-4, 1996.
- Zaret, M.M. Selected cases of microwave cataract in man associated with concomitant annotated pathologies. In *Biologic Effects and Health Hazards of Microwave Radiation: Proceedings of an International Symposium*, Warsaw, 15-18 Oct., 1973, P. Czerski et al., eds., pp. 294-301.
- Zalyubovskaya, N.P. and Kiselev, R.I. Effect of radio waves of a millimeter frequency range on the body of man and animals. *Gigiyena i Sanitariya* 8:35-39, 1978. JPRS 72956, pp. 9-15.
- Zmyslony, M., Gadzicka, E., Szymczak, W. and Bortkiewicz, A. Evaluation of selected parameters of circulatory system function in various occupational groups exposed to high frequency electromagnetic fields. II. Electrocardiographic changes. *Medycyna Pracy* 47(3):241-252, 1996.

About the Author

Arthur Firstenberg is chairman of the Cellular Phone Taskforce, a citizens' group formed in response to the uncontrolled growth of the cellular phone industry. He was electrically injured in 1981 after three years in medical school at the University of California, Irvine. A holistic health practitioner, he is also an expert in the effects of technology upon the environment. He has been studying and writing about electromagnetic radiation for the past 15 years.

## APPENDIX B



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
WASHINGTON, D.C. 20460

OCT 8 1996

OFFICE OF  
AIR AND RADIATION

David Fichtenberg  
P.O. Box 7577  
Olympia, WA 98507-7577

Dear Mr. Fichtenberg:

Thank you for your E-mail letter of October 2, 1996, that asks for clarification of a statement in the letter (July 25, 1996) from Environmental Protection Agency (EPA) Administrator Carol M. Browner to Federal Communications Commission (FCC) Chairman Reed E. Hundt. You request explanation of the statement, "this new approach is consistent with our comments made in 1993 and addresses our concerns about adequate protection of public health," with questions that pertain to acute thermal exposures, long-term (chronic) nonthermal exposures, and specific absorption rate (SAR).

The aforementioned letter was a response to a Mr. Hundt's request (July 1, 1996) that EPA review the FCC's approach to developing new guidelines. The EPA discussion of the original FCC Notice of Proposed Rulemaking, "Guidelines for Evaluating the Environmental Effects of Radio frequency (RF) Radiation, ET Docket No. 93-62," resulted in recommendations to the FCC (November 9, 1993). One of those recommendations was that the FCC adopt the exposure criteria recommended by the National Council on Radiation Protection and Measurements (NCRP) in NCRP Report No. 86, "Biological Effects and Exposure Criteria for Radio frequency Electromagnetic Fields," instead of the 1992 ANSI/IEEE standard that was originally proposed.

The FCC concluded its rule-making activity in August 1996, and adopted RF radiation exposure limits that are generally based on the NCRP guidelines as was recommended by EPA. In addition the FCC specified (in the introduction to its Report and Order FCC 96-326) that the maximum permissible exposure limits adopted are based on exposure criteria quantified in terms of specific absorption rate, and that the SAR limit is 4 watts per kilogram (W/kg).

EPA was very specific in our 1993 comments regarding the sufficiency of available information (on the health effects of RF radiation) to provide a basis for developing exposure standards. In the context of those comments, the FCC's resulting rule that generally followed the NCRP guidelines, and the FCC's explicit statement that the limits adopted are based on the SAR limit of 4 W/kg, EPA believes that our concerns about adequate protection of public health were addressed by the FCC. The FCC does not claim that their new exposure guidelines provide protection for effects to which the 4W/kg SAR basis does not apply.



A key conclusion of EPA's Radio frequency Radiation Conference, April 1993 (see "Summary and Results of the April 26-27, 1993, Radio frequency Radiation Conference," Vol. 1: Analysis of Panel Discussions, EPA Report 402-R-95-009, March 1995) is that "There is sufficient information on thermal exposure/effects on which to base a standard. However, participants generally felt that more information needs to be obtained on nonthermal effects." This is reflected in EPA's November 1993 comments to the FCC. These include the following:

"While studies continue to be published describing biological responses to nonthermal ELF-modulated RF radiation, the effects information is not yet sufficient to be used as a basis for exposure criteria to protect the public against adverse human health effects."

"It is clear that the adverse effect threshold of 4 W/kg is based on acute exposures (measured in minutes or a few hours) that elevate temperature in laboratory animals including nonhuman primates, and not on long-term, low-level (non-thermal) exposure. Only a few chronic exposure studies of laboratory animals and epidemiological studies of human populations have been reported. The majority of these relatively few studies indicate no significant health effects are associated with chronic, low-level exposure to RF radiation. This conclusion is tempered by the results of a small number of reports suggesting potentially adverse health effects (cancer) may exist (...).

"The thesis that the 1992 ANSI/IEEE recommendations are protective of all mechanisms of interaction is unwarranted because the adverse effects level in the 1992 ANSI/IEEE standard is based on a thermal effect."

"While there is general, although not unanimous, agreement that the data base on low-level, long-term is insufficient to provide a basis for standards development, some contemporary guidelines state explicitly that their adverse-effect level is based on an increase in body temperature (NRPB 1993). Furthermore they do not claim that the exposure limits protect against both thermal and nonthermal effects."

With this background established, I will proceed to provide my responses to your other questions.

- Q. Is it correct to conclude that the "adequate protection of public health" noted above, refers to "protecting against thermally related effects in humans?"
- A. As I have previously noted, while there is sufficient information on thermal exposure/effects on which to base a standard, the data base on low-level, long-term exposure is insufficient to provide a basis for standards to protect the public against adverse human health effects that may result from long-term, nonthermal exposures. Both the NCRP and ANSI/IEEE standards are thermally based, and do not apply to chronic, nonthermal exposure situations. The statement referring to "adequate protection" pertains to thermally related effects.